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A Survey of Methods used for Cardiac Risk Assessment Prior to Major Vascular Surgery

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Objectives: *To assess the frequency with which various methods of cardiac risk assessment are used prior to major vascular surgery and the way in which patients considered to be "high" risk are managed.*
Design: *Questionnaire survey.*
Setting: *Great Britain and Northern Ireland.*
Materials: *Vascular Surgeons who are current members of the Vascular Surgical Society of Great Britain and Northern Ireland.*
Chief outcome measures: *Number of respondents reporting routine or frequent use of particular investigations and methods of management.*
Main results: *Of 246 respondents, 52% had access to a high dependency unit and 77% used intensive therapy units routinely following aortic reconstruction. Some measure of ejection fraction was the most common investigation and was used routinely prior to aortic reconstruction by 35% and often by 33% of respondents, this being more frequent in respondents from teaching hospitals and those carrying out a greater number of reconstructions. Calculated clinical risk indices were rarely used. The identification of high risk patients led to referral to a cardiologist for 90% of respondents and influenced the choice of anaesthetist for 50%.*
Conclusions: *It is concluded that there is considerable variation in practice, but that those who carry out more vascular surgery are more aggressive in their assessment of cardiac risk prior to reconstruction.*

Key Words: Vascular surgery; Cardiac risk assessment; Cardiac ejection fraction.

Introduction

The most frequent cause of mortality following major vascular surgery is myocardial infarction. The probability of a perioperative cardiac event is the most important factor in determining the risks that must be weighed against the potential benefit of proposed treatment. A variety of methods have been suggested for cardiac risk assessment prior to surgery. Simple clinical parameters based upon history, examination and ECG may be used independently or combined to create calculated risk indices, such as the Goldman[1] or Detsky[2] index. More invasive investigations include stress testing using exercise ECG or dipyridamole/thallium scans,[3,4] echocardiographic[5] or radioisotope[6] methods of measuring cardiac ejection fraction and coronary angiography.[7]

A questionnaire survey of vascular surgeons has been undertaken to assess the frequency with which the various methods are used amongst vascular surgeons in the U.K. and the way that patients considered to be "high" risk are managed.

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Materials and Methods

Questionnaires were sent to all members of the Vascular Surgical Society of Great Britain and Northern Ireland. Information was requested about which particular methods of assessment were routinely or frequently used for patients about to undergo aortic or infra-inguinal vascular reconstructive operations. Questions were also asked regarding access to a high dependency unit (HDU), the routine use of an intensive therapy unit (ITU) after aortic operations and the ways in which risk assessment affects patient management.

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Table 1. Vascular workload of respondents from Teaching Hospitals and District General Hospitals (median and interquartile range)

	Teaching Hospital	District General Hospital
Number of aortic reconstructions per year	35 (20–60)	25 (16–40)*
Number of infrainguinal reconstructions	45 (30–65)	30 (20–40)*
Proportion of workload which is vascular surgery	78 (50–95)	50 (30–50)*

*=$p<0.001$ Mann Witney U-test.

Results

There were 361 questionnaires sent out with 246 replies received (68%). Of these 31% were from consultants working in Teaching Hospitals and 69% from District General Hospitals. Amongst respondents the median proportion of workload (and interquartile range) which was vascular as opposed to general surgical was 50% (30–70%). A median of 30 (20–40) aortic and 30 (20–50) infrainguinal reconstructions were carried out per year by each consultant. More vascular procedures were carried out by consultants working at Teaching Hospitals and the proportion of their work which was vascular was significantly greater (Table 1). Of all those questioned 52% had access to HDU beds and 77% used ITU routinely after aortic reconstructions. Those with access to HDU were significantly less likely to use ITU routinely ($p < 0.001$, chi-squared test). Teaching Hospital consultants were more likely to have access to HDU and less likely to make routine use of ITU ($p < 0.01$, chi-squared test, Fig. 1).

Other than clinical assessment, the commonest investigations to be carried out routinely were Echocardiographic or radio-isotope ejection fractions, assessment by a cardiologist or exercise ECG (Table 2). Calculation of a risk index from clinical data was rarely undertaken. In total, some form of assessment of ejection fraction was used routinely by 35% of respondents and often by a further 33%. These investigations were used significantly more frequently by surgeons working in Teaching Hospitals ($p < 0.01$, chi-squared test for trend) and those carrying out a greater number of grafts ($p < 0.01$, Spearman Rank Correlation, Fig. 2).

All forms of evaluation were considerably less frequent in patients undergoing infrainguinal grafts, although ejection fractions and exercise stress tests remained the most commonly used methods (Table 2).

Once high risk patients were identified, 90% would refer to a cardiologist or cardiac surgeon, for 50% it would influence the choice of anaesthetist and 18% would admit to ITU preoperatively. These percentages were all smaller for those carrying out a low volume of cases and it was less common for referral to a cardiologist to be made by consultants working in a District General Hospital (Table 3).

Discussion

Major vascular reconstruction, particularly aortic operations, carries a substantial mortality and morbid-

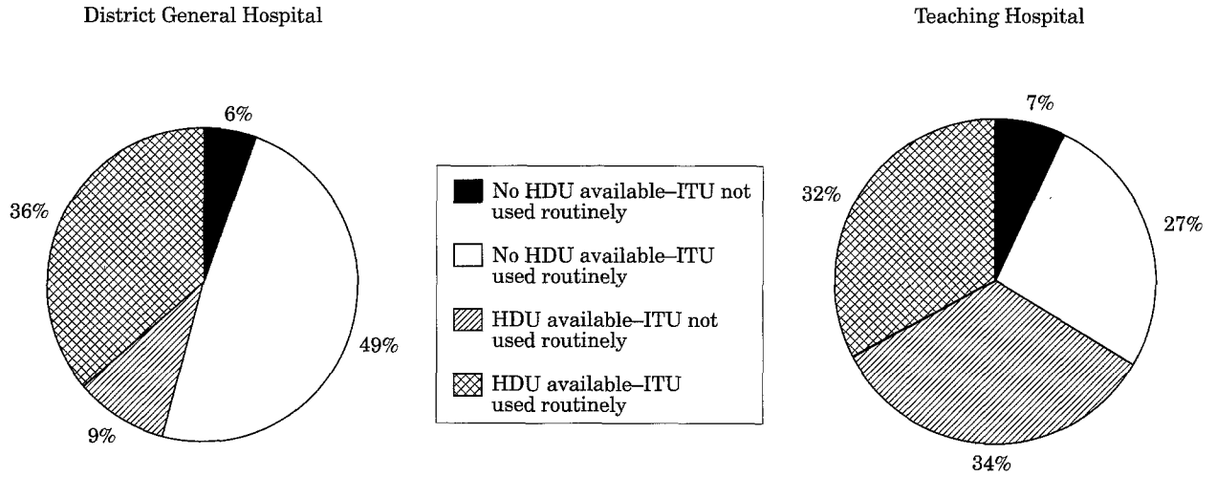

Fig. 1. Availability of high dependency unit (HDU) and routine use of intensive therapy unit (ITU) for elective aortic surgery.

Table 2. Methods of assessment used routinely or frequently prior to vascular surgery (percent of respondents)

	Aortic		Infrainguinal	
	Routine	Frequent	Routine	Frequent
Exercise ECG	8	43	4	26
Dipyridamole/thallium stress test	7	19	1	13
Calculated index	5	7	2	5
Coronary angiography	0.5	17	0.5	6
Ejection fraction (MUGA)	17	19	2	11
Ejection fraction (Echocardiogram)	23	36	4	29
Ejection fraction (any)	35	33	5	35
Any further cardiac assessment (other than clinical and ECG)	48	41	13	51

ity. Studies have suggested that a mortality of up to 20% may be associated with aortic reconstructions in some centres.[8] This mortality is mostly related to cardiac events.[9] All the methods described in this study have been suggested as possible ways to stratify patients according to cardiac risk.

It is essential to quantify the risk associated with surgery because, for many operations, the risk-benefit equation is quite finely balanced. For example, an operation for a small, asymptomatic abdominal aortic aneurysm which is appropriate in an otherwise fit individual may be inappropriate if there is an increased risk of a cardiac event.[10] It may also be necessary to carry out a selection process on the basis of risk in order to decide if patients require special perioperative precautions, including more intensive or invasive monitoring. The fact that the choice of anaesthetist was frequently altered, particularly in DGH practice, may reflect the increasing trend

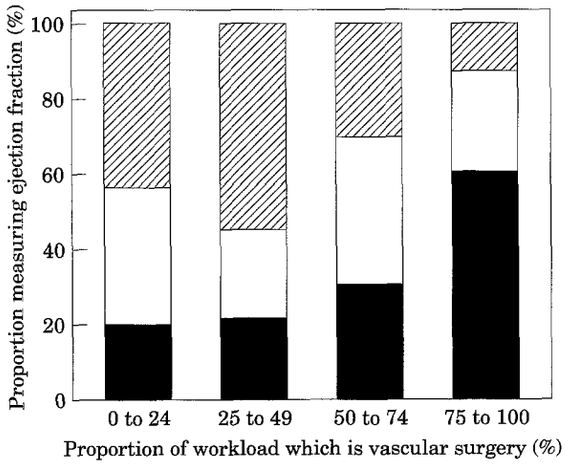

Fig. 2. The use of measurement of ejection fraction prior to elective aortic surgery *vs.* the proportion of workload which relates to vascular surgery. (▨) seldom/never; (□) frequent; (■) routine.

Table 3. Action taken if a high risk patient is identified (percent responding positively)

	Teaching Hospital	District General Hospital
Influences the choice of anaesthetist	45	52
Preoperative ITU admission	15	18
Referral to cardiologist or cardiac surgeon	99	86*

*=$p<0.01$ Chi-squared test.

towards sub-specialisation within anaesthetics as well as surgery.

The results of this study show considerable variation in practice as regards the methods of assessment used prior to vascular surgery. To some extent this may reflect the differing availability of particular techniques and skills. Echocardiographic ejection fractions are used more commonly than radioisotope methods, although the latter is probably more accurate.[11] Referrals to cardiologists are more common in Teaching Hospitals where cardiologists may be more easily available. There is some evidence that an aggressive policy of investigation and treatment of coexisting cardiac disease may be of benefit in high risk patients.[7]

Although calculated indices require very little effort or expense and may provide useful information they are very rarely used formally to assess risk. This may be part of a general reluctance to use formalised methods for influencing clinical decisions. However, there is evidence to suggest that such indices may be as accurate as more invasive tests in determining cardiac risk.[11]

One feature which must raise concerns is the difference in practice between those carrying different volumes of vascular surgery, whether calculated by proportion of time spent on vascular surgery or the actual number of reported reconstructions. It would appear that those carrying out lower volumes of vascular surgery carry out fewer investigations in their pre-operative risk assessment. One possible explanation for this is that they are selecting lower risk patients, requiring less assessment, or that higher risk patients are preferentially referred to certain centres. If this is true then it is clearly necessary to take this into account in comparing outcomes between surgeons and centres. However, wide scale studies do not suggest that this is the case, usually demonstrating higher mortality and morbidity amongst low volume centres.[12]

If the potential risks and benefits of treatment are to be fully explained to patients, and if surgeons are to make appropriate decisions where the choice between

treatment options is borderline, then it is essential that there is a move towards more formal assessment of operative risks so that difficult decisions can be adequately informed.

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